

RECOMMENDED PERFORMANCE WORK STATEMENT (PWS) FOR DISTRIBUTION OF AFRTS SIGNALS THROUGH LOCAL CABLE SYSTEMS

1.0 SCOPE:

The purpose of this Performance Work Statement (PWS) is to set forth the specifications and requirements to provide for the design, furnishing, installation, testing, and operation of a Community Antenna RF Distribution System (CATV). American Forces Radio and Television Service (AFRTS) has reserved a specific frequency band on all new cable systems installed on Military installations and Military Housing areas as described in this PWS. This requirement is necessary to ensure that American NTSC television receivers and related products will operate on new and existing cable systems. This PWS is for OCONUS locations/installations only.

NOTES TO LOCAL COMMAND: The Contracting Officer/local Government Technical Representative may make additions or deletions to this PWS as required to reflect local codes.)

2.0 REFERENCES:

2.1 The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

2.2 CODE OF FEDERAL REGULATIONS (CFR)

2.3 47 CFR 15 Radio Frequency Devices

2.4 47 CFR 17 Construction, Marking, and Lighting of Antenna Structures

2.5 47 CFR 25 Satellite Communications

2.6 47 CFR 76 Cable Television Service

2.7 ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

2.8 EIA ANSI/EIA/TIA -222-F - (1995) Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

2.9 EIA ANSI/EIA-411-A - (1986) Electrical and Mechanical Characteristics of Earth Station Antennas for Satellite Communication

2.10 INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

2.11 IEEE C2 - (1997) National Electrical Safety Code

2.12 NATIONAL CABLE TELEVISION ASSOCIATION (NCTA)

2.13 NCTA-02 - (1989; Revised Oct 1993) NCTA Recommended Practices for Measurements on Cable Television Systems

2.14 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

2.15 NFPA 70 - (1996) National Electrical Code

2.16 NFPA 780 - (1995) Installation of Lightning Protection Systems

2.17 UNDERWRITERS LABORATORIES (UL)

2.18 UL 467 - (1993; Rev thru Aug 1996) Grounding and Bonding Equipment

3.0 GENERAL REQUIREMENTS:

3.1 Standard Products: Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

3.2 Nameplates: Each major component of equipment shall have the manufacturer's name, model and serial number secured to the equipment.

3.3 Verification of Dimensions: The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

4.0 SYSTEM DESCRIPTION:

4.1 The Community Antenna Television System (CATV) signal is originated from off-air antennas (FM and Television), satellite receive only antennas and local cable systems. These RF signals are combined and amplified for transmission to the end users via a coaxial cable distribution system.

4.1.1 The system shall consist of both Government Furnished Equipment (GFE) and Contractor Furnished Equipment (CFE). All miscellaneous items, not specifically identified by this PWS, shall be provided by the Contractor to meet the performance requirements as defined.

4.1.2 The system shall utilize industry standard, commercially off the shelf (COTS) components consisting of antenna systems, electronic active and passive devices to

receive and distribute the RF signals to the end user. This equipment must meet the specifications and requirements listed herein.

4.1.3 The system shall comply with 47 CFR 15, 47 CFR 25, and 47 CFR 76. The system shall be designed to provide continuous entertainment on a series of CATV channels selectable by the users. All off-air channels received shall be translated to a CATV channel before distribution over the cable network.

4.2 System Configuration:

4.2 The system shall consist of log-periodic or yagi antenna for off-air signal reception, satellite earth station antennas and receivers for satellite reception, passive/active head-end components and associated cable distribution equipment. The head-end equipment shall serve as an interface between the receiving antennas and the cable distribution system to allow for signal processing, modulation, amplification, equalization and reception.

4.2.1 Cable Distribution System: The cable distribution system shall consist of coaxial cables, user interfaces, signal taps, splitters, RF amplifiers, signal equalizers, power supplies, and ancillary hardware as required to meet the system requirements specified.

4.2.2 Amplifier: Broadband (Launch): The broadband amplifier shall provide a minimum of 35 adjacent TV channel operation with separate adjustable gain and slope controls. It shall be UL approved lightning/surge protection.

4.2.2.1 Technical Characteristics

Frequency Response:	± 1.5 dB, 54-750 MHz
Noise Figure:	10 dB Max.
Output Capability:	45 dBmV Min., 35 channels
Cross Modulation:	-46 dB
Gain Control Range:	10 dB
Slope Control:	0-8 dB @300 MHz
Connectors:	"F"
Impedance:	75 Ohm

4.2.3 Splitter/Combiner: The splitter/combiner shall be ruggedized construction in a radiation proof metal housing. It shall provide multiple isolated outputs from a single input, or conversely, a single output from multiple isolated inputs. The unit shall be design for the application (i.e. a splitter should not be used as a combiner in the reversed configuration).

4.2.3.1 Technical Characteristics:

Bandpass:	50-750 MHz
Tap-Tap Isolation:	17 dB

Splitting Loss:	2-Way (4 dB Max.) 4-Way (7.5 dB Max.) 8-Way (12 dB Max.)
Connectors:	"F"
Impedance:	75 Ohm

4.2.4 Directional Coupler: The directional coupler shall be encased in a ruggedized radiation proof metal housing.

4.2.4.1 Technical Characteristics

Outputs	1 each
Insertion Loss	1.3 dB Max.
Tap Loss	8 dB Min.
Isolation Tap-Output	25 dB Min.
Bandpass	50-750 MHz
Connectors	"F"
Impedance	75 Ohm

4.2.5 Directional Multi Tap: The multi tap shall be a directional coupler type and encased in a ruggedized radiation-proof metal housing. It shall come in multiple tap values.

4.2.5.1 Technical Characteristics:

Tap Loss:	8 dB Min.
Bandpass:	50-750 MHz
Insertion Loss:	3.7 dB Max.
Isolation Tap-Output:	28 dB
Connectors:	"F"
Impedance:	75 Ohm

4.2.6 TV Receiver Wall Outlet:

4.2.6.1 The TV receiver wall outlet shall consist of an RF jack.

4.2.6.2 All RF cable connections to wall outlets shall be screw on "F" cable connectors.

4.2.6.3 The wall outlet shall be fed from a directional coupler, multi-port, or be a directional coupler.

4.2.6.4 The wall outlet shall be provided with a cover plate and RF "F" Female Jack installed.

4.2.7 TV Receiver Connection Cable

4.2.7.1 Coaxial Cable: A connection cable shall be provided by the Contractor for each TV outlet in the MATV system with ten percent spares. The cable shall connect the TV receiver to the RF jack.

4.2.7.1.1 Technical Characteristics

Length:	1800 mm (6 feet)Min.
Cable:	RG-6 double shielded type
Connector:	Screw-on "F" Male at both ends.

4.3 System Hardware Design:

4.3.1 The system hardware shall utilize modular plug-in components to provide maximum flexibility, ease of maintenance, and expansion where practicable.

4.3.2 Solid state and integrated circuitry shall be employed. Mechanical and electro-mechanical relays, tuning controls, and other mechanical components and parts shall not be used where the necessary functions can be performed in a more reliable manner by electronic components.

4.4 Maintenance Accessibility:

4.4.1 Parts which require periodic service or maintenance shall be easily accessible. Test points shall be provided at the Head-end Combiner and all Amplifiers and shall be designed so measurements of the system can be performed without affecting the system performance.

4.5 System Design:

4.5.1 Depending on site requirements this design could be a Master Antenna Television system (MATV) or a Satellite Master Antenna system (SMATV) where off-air and/or cable services along with satellite received services are distributed through a cable system.

4.6 Cable Television Feeds:

4.6.1 The system shall be designed to interface with the local area cable system. If different formats (i.e. PAL, SECAM, NTSC) are distributed on one common trunk cable the different formats shall be bandpass filtered at the head-end. The American Forces Radio and Television Service (AFRTS) shall occupy the 54 Mhz to 216 Mhz region of the cable bandwidth exclusively.

4.6.2 Off-Air Stations:

4.6.2.1 Programming received from the local area stations may be distributed on the cable distribution system on assigned CATV channels (as required by the local Command).

4.7 Audio Programming

4.7.1 Programming received from AFRTS radio channels shall either be distributed on the FM band or on unused TV channels with the TV Guide as a video source (as required by the local Command).

4.8 Satellite TVRO Programming

4.8.1 Programming received from AFRTS shall be distributed on the cable distribution system. Additional services from European sources (both local and Satellite) may be distributed as determined by the local Command.

4.9 System Configuration

4.9.1 This specifies the furnishing, installing and testing of a complete MATV/SMATV system, and associated equipment. The system shall include, off-air antenna masts, distribution amplifiers, cable and connectors, necessary passive devices such as splitters, directional couplers, and TV outlets.

4.9.2 The MATV/SMATV system shall be delivered free of engineering, manufacturing, installation and operating defects. The system shall be engineered and installed for ease of operation, maintenance and testing.

4.9.3 The MATV/SMATV system shall provide for connection of a standard CATV capable TV receiver to the designated TV outlets located in residential homes, dormitories, day rooms, and office areas as approved by the Command. The TV outlets shall be installed on the ceiling or wall locations as approved by the Base Housing office and Command. All ceiling mount TV locations will have the CATV wall outlet plate and AC power duplex within 6ft. of the mount locations.

4.9.4 The Contractor shall furnish and install single duplex outlet wall plates consisting of one (1) RF output jack to each location identified on the engineering drawings.

4.9.5 Location: The antenna(s) mast shall be installed at the highest practical location to ensure optimum reception of all TV signals. The antennas masts shall have a minimum of 10 feet of horizontal clearance from all obstructions on the roof where located.

4.9.6 Cable labels with the number identified shall be installed on the wall plate end of the cable and also at the directional tap, multi-port or splitter end of the same cable.

4.10 System Performance

4.10.1 The signal level of each channel at each TV outlet shall be +8 DbmV, plus or minus 5 DbmV.

4.10.2 The MATV/SMATV system shall meet the following minimum parameters at each TV outlet.

4.10.2.1 Technical Characteristics:

Signal-To-Noise Ratio:	43 dB
Cross Modulation:	-46 dB
Hum Modulation:	-55 dB
Return Loss:	14 dB
Isolation (outlet-outlet):	24 dB
Aural Carrier Level:	13 dB to 17 dB below visual
Impedance:	75 ohm

5.0 SUBMITTALS

5.1 The submittal shall be separated into sections for each subsystem and shall contain the following:

5.1.1 Title page to include:

5.1.1.1 Site Location

5.1.1.2 Proposer's name, address, and telephone number

5.1.1.3 Date of Submittal

5.1.1.4 Narrative Description of System.

5.1.1.5 A List of the equipment to be furnished. The quantity, make and model number of each item is required.

5.1.1.6 Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

5.1.1.7 Engineering drawings of the system, showing calculated signal levels at each input and output point in the system with the proposed tap values and signal levels at each tap off point.

5.1.2 List of test equipment.

5.1.2.1 As Built Wiring Diagrams:

5.1.2.1.1 Five (5) working days prior to the acceptance test, the Contractor shall deliver four (4) complete sets of as-built wiring diagrams of the system(s) to the TCOR. The diagrams shall show all inputs and output signal levels of the electronic and passive equipment. The routing of the RF cables, Amplifiers, Couplers, Splitters and distribution taps. The RF taps shall be identified by tap value and by the markers installed on the interconnecting cables.

6.0 DELIVERY AND STORAGE:

6.1 Equipment shall be delivered in original packages with labels intact and identification clearly marked. Equipment and components shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

7.0 ENVIRONMENTAL CONDITIONS:

7.1 System components located inside buildings shall conform to the specified performance when subjected to any combination of the following environmental conditions:

Temperature: At 4 to 38 degrees C (40 to 100 degrees F)
Relative humidity: From 0 to 100 percent (no water condensation)

8.0 PRODUCTS:

8.1 Antennas

8.1.1 Antennas used for television off-air reception shall be yagi or log-periodic type. The antennas shall be cut-to-channel or broadband. Satellite TVRO antennas shall be models designed for heavy-duty commercial use.

8.1.2 Off-Air Antennas

8.1.3 Mechanical Specifications

8.1.3.1 Cross-arms shall be high-strength aluminum alloy, seamless, with ends sealed.

8.1.3.2 Elements shall be high-strength aluminum alloy tubing, 10 mm (3/8 inch) 3/8 inch diameter, 635.0 micrometers (.025 inch) wall thickness.

8.1.3.3 The antenna shall be rated for an operational/survival wind velocity of 160.9 km per hour (100 mph) with no ice. All antennas shall be completely weatherproofed. The aluminum shall have an electrically conductive anti-corrosion (anodized) finish. All metals for installation and mounting shall be high-strength non-corrosive type. No drilling shall be required for installation.

8.1.4 The antenna cable connector shall be a built in, 75 ohm anodized brass, type F - 61 connector.

8.1.5 Electrical Specifications

8.1.5.1 The antenna shall as a minimum conform to the following specifications:

Gain Front-to-Back:	8 dBi
Ratio:	18
Output Impedance:	75 plus or minus 2 ohms unbalanced
Maximum VSWR:	1.5:1
Frequency Range:	To be determined by the location

8.1.5.2 FM Antennas

8.1.5.2.1 Antennas used for FM broadcast reception shall be incorporated in the broadband log-periodic. The antenna shall be designed for commercial application and be completely weather and corrosion resistant. Electrical characteristics shall be the same as specified for the television off-air antennas with the exception of gain which shall be 2 dBi minimum for omni-directional or 7 dBi for separate directional and broadband antennas.

8.1.5.3 Satellite Earth Station Antenna

8.1.5.3.1 Antennas used for satellite reception shall be designed for commercial television receive only (TVRO) applications. Antenna performance characteristics shall conform to the standards and requirements set forth in 47 CFR 25 and EIA ANSI/EIA - 411-A. Satellite earth station antennas shall be fixed-dish and dual polarized. The satellite earth station antenna shall be equipped with low noise block converters (LNB) at the feed horn.

8.1.5.3.2 One LNB shall be provided for each antenna polarization (unless signal stacking is used). The LNBs shall as a minimum conform to the following specifications:

C-Band Input frequency range:	3.7 to 4.2 GHz
Level	Minus 75 to minus 95 dBm per carrier
Return Loss:	14 dB
LNB Output frequency range:	950 to 1450
Impedance:	75 ohms
Return Loss:	10 dB
Conversion Gain:	56 dB plus or minus 6 dB
Image Rejection:	50 dB
Maximum Noise Figure:	1.3 dB
Connector:	Type "F" Female

Ku Band Input frequency range:	10.7 to 12.2 GHz
Level:	Minus 75 to minus 95 dBm per carrier
Maximum VSWR:	2.5:1
LNB Output frequency range:	950 to 1450 MHz
Impedance:	75ohms
Maximum VSWR:	2.5:1
Conversion Gain:	54 plus or minus 4 dB
Image Rejection:	50 dB
Maximum Noise Figure:	2.5 dB

8.1.5.4 Antenna Support Towers

8.1.5.4.1 Antenna support towers shall be designed to EIA ANSI/EIA/TIA -222-F specifications and adhere to FAA AC 70/7460-1 and 47 CFR 17 requirements. Appropriate offset antenna-tower mounts and down lead cable supports shall be provided.

8.1.6 Transmission Lines

8.1.6.1 Transmission lines connecting the antennas and head-end equipment shall be low-loss, foam dielectric coaxial cable.

9.0 HEAD-END EQUIPMENT

9.1 General

9.1.1 The head-end shall utilize processors for channel translation or demodulators/modulators to insert off air channels into the CATV cable band. A broadband amplifier with combining networks for receiving AFRTS satellite services, off-air television, and interfacing them with the cable distribution system. Coaxial down lead of the off-air antennas shall be provided with preamplifiers as required to supply the proper signal level input required by the head-end equipment. Satellite receivers shall be used to receive and tune signals from the satellite earth station antennas. RF Modulators shall be supplied to modulate each satellite station to the appropriate CATV channel as specified for system performance.

9.1.2 Coaxial Down lead Preamplifiers

9.1.2.1 Preamplifiers shall be single channel or broadband type. The amplifier shall be enclosed in a weatherproof housing with a universal bracket. Appropriate power supplies and power inserters shall be provided to power the preamplifiers through the coaxial down lead cable. Lightning protection shall be inherent in the preamplifiers design. The preamplifiers shall as a minimum conform to the following specifications:

Frequency Response:	Plus or minus 0.75 dB
Minimum Input:	Minus 20 dBmV
Return Loss:	14 dB
Impedance:	75 ohms
Maximum Noise Figure:	VHF 6.5 dB / UHF 7.5 dB

9.1.3 Cable Distribution Plant

9.1.3.1 Coaxial Cable

9.1.3.2 Coaxial cable shall be used to connect head-end equipment to the user interface. Allowable losses between components and user interface dictated by system design and construction considerations shall determine the size and type of coaxial cable.

9.1.3.3 All coaxial cables used for wiring within a building shall conform to NFPA 70. Non-plenum inside plant cables with a 12.7 mm (0.500 inch) OD or larger shall meet all requirements specified for outside plant cables, with the exception of the outer jacket [and armoring]. The inside plant cabling 12.7 mm (0.500 inch) OD or larger shall be non-jacketed with a bare outer conductor. Inside plant cables less than 12.7 mm (0.500 inch) OD shall be PVC jacketed and shall have a braided copper or aluminum outer conductor with 65 plus or minus 5 percent braid coverage. The inner conductor shall be copper clad steel wire or solid copper and an aluminum foil bonded to the outside of the dielectric. The cable shall have a polyethylene foam dielectric unless used in plenum applications. Where cabling is to be placed in plenum, ducts and other air-handling spaces the cable shall meet NFPA 70.

9.1.4 Electrical Characteristics

9.1.4.1 The following types of cables are acceptable for use in the distribution system. The cables shall as a minimum conform to the following specifications:

9.1.4.2 Cables 12.7 mm (0.500 inch) OD and larger:

Max Attenuation at 20 degrees C (See tables below for max. loss per 100 ft)

Frequency (MHz)	55MHZ	216MHZ	300MHZ	750MHZ
Acceptable Type (OD)				
12.7 mm (.500)	0.54	1.10	1.32	2.26
19.1 mm (.750)	0.37	0.76	0.91	1.60
Characteristic Impedance:	75 plus or minus 2 ohms			
Capacitance (per ft.):	15.5 picofarads			
Velocity of Propagation:	87 percent			
Minimum Structural Return Loss:	26 dB			

9.1.4.3 DC Resistance at 20 degrees C (68 degrees F)

Type (OD)	0.500 IN.	0.750IN.
Inner Conductor:	1.34 ohm	0.57ohm
Outer Conductor:	0.39 ohm	0.18 ohm

9.1.4.4 Cables less than 12.7 mm (0.005 inch) 0.500 inch OD:

Max Attenuation at 20 degrees C. (See tables below for max. loss per 100 ft)

Frequency (MHz)	55MHZ	216MHZ	300MHZ	750MHZ
RG-59	2.05	3.80	4.45	7.10
RG-6	1.05	3.05	3.55	5.50
RG-11	0.96	1.90	2.25	3.48

Characteristic: Impedance 75 plus or minus 2 ohms

Capacitance: 0.0558 picofarads per mm (17 picofarads per foot)

Velocity of Propagation: 81 plus or minus 3 percent

9.1.5 Distribution Amplifier

9.1.5.1 Distribution amplifiers shall be provided as required to deliver the minimum required signal parameters specified in the System Description (Section 1.3.2). All amplifiers shall be designed for heavy duty commercial and industrial applications.

9.1.5.2 Outdoor Amplifier

9.1.5.2.1 Weatherproof aluminum housing shall be provided for either pedestal or messenger mounting and shall be fitted with a silicone rubber gasket to ensure effective protection against environmental contaminants, and a metal mesh gasket for RFI radiation and interference isolation. Each casting shall be pressure tested to withstand 20 psi. Convection cooling fins shall be provided as an integral part of the housing. The cable entry ports shall have stainless steel or brass threaded inserts for mechanically strong, corrosion-resistant cable connections. The cover bolts shall be stainless steel and held captive to the cover plates. External RF test point connectors should be provided to monitor signals without opening the housing. The test points shall be 20 dB current transformer-type. A surge protection module shall be provided on all cable entry ports. Each of the cable entry ports shall be capable of passing 10 amperes without damage. The outdoor distribution amplifiers shall be cable-powered. The RF section of the distribution circuitry shall be an integral part of the plug-in main RF chassis. The individual components, including amplifiers, filters, splitters, pads, equalizers, and automatic level control circuitry, shall be modular in construction and

plug into the main RF chassis. All modular connections shall be made through rugged connections able to withstand rough field handling.

9.1.5.3 Indoor Amplifiers

9.1.5.3.1 As a minimum, indoor amplifiers shall be contained in a wall-mountable, steel or aluminum housing, and vented or finned for convection cooling. The cable ports shall be stainless steel or brass threaded "F" type connectors for mechanically strong, corrosion resistant cable connections. External RF test points shall be provided to monitor signals without opening the housing. Indoor amplifiers may be powered through the cable or by a 110-240 VAC, 50/60Hz source (dependent on local power). A surge protection module shall be provided on cable entry ports. Cable powered amplifiers shall be capable of passing a maximum of 10 amperes through cable ports without damage. The individual components, amplifiers, filters, splitters, pads, equalizers and automatic level control circuitry shall be modular in construction and plug into the main RF chassis. All modular connections shall be made through rugged connections to withstand rough field handling.

9.1.5.4 Signal Splitter

9.1.5.4.1 The cable distribution system shall utilize signal power splitters, directional couplers, and isolation taps as required to meet the system performance requirements. Signal splitters shall have a power throughput capability of 6 amperes minimum when amplifiers are to be powered through the cable. All signal splitters shall be contained in rugged weatherproof anodized aluminum or other noncorrosive metal housing with brass connector ports. In addition to the above specifications, the splitters shall as a minimum conform to the following specifications:

Impedance:	75 ohms unbalanced
Return Loss:	17 dB
RFI Shielding:	100 dB
Isolation:	25 dB

9.1.6 Cable System Power Supply

9.1.6.1 The cable system power supply required for cable powered amplifiers shall be 100 percent plug-in modular construction and include lightning surge, short circuit, and overload protection. Circuitry shall be fully protected by circuit breakers. The supply shall be housed in a fully weatherproofed steel cabinet, and shall as a minimum conform to the following specifications:

Input voltage:	95-240 VAC, 50/60 Hz (dependent on local power)
Output voltage:	30 to 90 VAC as required by amplifiers
Output Current:	8 to 15 Amperes @ 30 to 90 VAC
Line Regulation:	Plus or minus 2 percent 95 - 240 VAC
Local Regulation:	Plus or minus 2 percent 1/3 of full load
Noise Level:	Less than 48 dB at 1 foot distance

9.1.7 Wall Outlets

9.1.7.1 Outlets with plates shall be wall or baseboard mounted and shall not protrude from the face of the wall more than 2 1/2 Inch. Each outlet shall have an attenuation of less than 0.1 dB and a VSWR of less than 1.15 to 1. Cable Connectors shall be 75 ohm Type "F". All metallic portions of connectors shall be composed of anodized brass, beryllium copper or phosphorus bronze. Outlet connector shall be Type "F" female plug.

10.0 INSTALLATION:

10.1 After award of contract, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner which fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the system without written approval from the Resident Engineer.

10.2 The Contractor shall install all equipment and systems in a manner which complies with accepted industry standards of good practice, the requirements of this specification and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understand and complies with all the requirements of this specification.

10.3 The Contractor shall install suitable filters, traps and pads for minimizing interference and for balancing the amplifiers and distribution system(s). All filters, splitters, couplers, tap off's, matching transformers and TV wall outlets shall be able to pass color TV channels in the frequency bands selected, in the directions specified, with low loss, and high isolation and with minimum delay of the color sub-carrier frequency. The Contractor shall install all equipment necessary to meet the requirements of paragraph 1.3 and the system performance standards.

10.4 All passive equipment shall be connected according to the manufacturer's specifications to insure correct termination, isolation, impedance match and signal level balance at each TV outlet.

10.5 All lines shall be terminated in a suitable manner to facilitate future expansion of the MATV system. There shall be a minimum of one (1) spare output at each distribution point on each Dormitory floor.

10.6 In multiple dwelling units no cable installation that allows one or more subscribers to affect the performance of the distribution system will be allowed.

10.7 Terminating resistors (75 Ohm) shall be used to terminate all unused branches, outlets, unused equipment ports of the system and shall be devices designed for the purpose of terminating coaxial cable carrying TV signals in MATV systems.

10.8 Equipment installed outdoors shall be weatherproof or installed in weather proof enclosures with hinged doors and locks with 2 keys.

10.9 RF Distribution Amplifiers installed indoors shall be installed in enclosures with proper ventilation.

10.10 Head-end Equipment

10.10.1 The components comprising the head-end equipment shall be located in the facilities specified. Grounding of the system shall comply with NFPA 70.

10.11 Distribution System Cable

10.11.1 The coaxial cable shall be an RG-6 double shielded (minimum) type with non-contaminating jacket, and certified 100% sweep tested by the Manufacturer by tags on each reel. The tags and a two-foot sample shall be delivered to the Resident Engineer prior to installation. The cable shall be able to pass the frequency spectrum from 5 to 890 MHz.

10.11.2 Technical Characteristics:

Center Conductor:	18 AWG
Dielectric:	Foam
Return Loss:	26 dB
Temperature Rating:	80 degrees C
Impedance:	75 Ohm
ATTENUATION:	Max. dB loss per100 ft.
	7 MHz 0.6
	54 MHz 1.8
	216 MHz 3.5
	470 MHz 4.7
	890 MHz 7.0

10.12 RF Connectors

10.12.1 The "F" connector shall have a screw type coupling for quick connect/disconnect of coaxial cable terminations. It shall be a crimp on integral ferrule connector designed to fit the coaxial cable furnished. The connector shall be installed using the connector manufacturer's approved crimping tool.

10.12.2 Technical Characteristics:

Working Voltage:	500 V
Frequency Range:	0 to 890 MHz
Impedance:	75 Ohms

10.12.3 Coaxial Cable Terminators

10.12.4 These units shall be metal housed precision types in the frequency range selected.

10.12.5 Technical Characteristics:

Frequency Range:	5-890 MHz
Power Blocking:	As required
Return Loss:	25 dB
Connectors:	"F",
Impedance:	75 Ohms

11.0 GROUNDING

11.1 Grounding shall be in accordance with applicable portions of NFPA 70, NFPA 780, IEEE C2, UL 467 and EIA ANSI/EIA/TIA-222-F. The maximum resistance to ground at the connection point for all system components shall be 25 ohms. The grounding conductors shall be as a minimum No. 6 AWG solid copper. Existing towers, if utilized, shall be made to conform to the above requirements. All system components shall have a direct connection to ground. Each cable at the point of building entry shall be grounded with a grounding block or be equipped with a surge protector to dissipate electrical surges. Grounding blocks shall be directly connected to a ground. All head-end equipment shall be equipped with surge protection either by inherent design or external device. Unless otherwise specified, lightning and transient surge protection shall be provided in accordance with NFPA 780.

12.0 TESTING:

12.1 The Contracting Officer shall be notified 30 days before systems are ready for acceptance tests. The acceptance tests shall be performed in accordance with the approved Test Plan and conform to NCTA-02. All instruments, personnel, and transportation required for the tests shall be provided by the Contractor.

12.1.1 Tests

12.1.1.1 Tests shall be performed on randomly selected equipment, components, and modules accepted by the TCOR, to determine if the system meets the specified requirements. An end-to-end system test shall be coordinated to determine if the System Performance requirements have been met. Deficient portions of the system shall be repaired and retested at the Contractor's expense.

12.1.1.2 Cable Testing

12.1.1.2.1 After installation of the cable and before splicing in the system components, each cable section shall be tested using a time domain reflectometer (TDR) to

determine shorts, open, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities shall be replaced at the Contractor's expense. There shall be no cable splices between system components unless approved by the Contracting Officer.

12.1.2 Inspection

12.1.2.1 The Government representative will tour all major areas to ensure that all MATV systems are completely and properly installed in place, and are operationally ready for proof of performance testing. Failure of the MATV/SMATV system to meet the installation requirements of this specification shall be grounds for terminating all testing. The MATV/SMATV system diagrams and pretest measurements shall be reviewed.

12.1.3 Distribution System Testing

12.1.3.1 The MATV/SMATV distribution system shall be checked at the first and last outlet in each leg to verify that the distribution system meets all performance requirements utilizing the spectrum analyzer or signal level meter and TV receiver. The proof of performance test results shall be provided to the CO/TCOR. This documentation will be used to evaluate the performance of the distribution system in future tests to be performed annually.

12.1.3.2 A random sampling of a minimum of 25% of the TV outlets shall be checked, unless incorrect levels indicate that a wide sample should be taken.